
खनिकों के लिए रबर कैनवास के
सुरक्षा जूते — विशिष्टि
(छठा पुनरीक्षण)

**Safety Rubber Canvas Boots for
Miners — Specification**
(*Sixth Revision*)

ICS 13.340.50

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भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फ़र मार्ग, नई दिल्ली-110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.org.in www.standardsbis.in

FOREWORD

This Indian Standard (Sixth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Footwear Sectional Committee had been approved by the Chemical Division Council.

This standard was first published as IS 3976 : 1967 'Safety rubber canvas boots for miners — Specification' and subsequently revised in 1975, 1982, 1992, 1995 and 2003. In fourth revision published in 1995, the emphasis was given on the performance requirements of sole and upper instead of prescribing material composition and their construction. The requirement for materials and accessories, thickness of components, method of test for performance of safety footwear, adhesion and consolidation tests were modified. The following additional requirements were also incorporated:

- a) Tensile strength of rubber sole,
- b) Elongation at break of rubber sole,
- c) Compression set of rubber sole, and
- d) Ageing of boots at $70 \pm 1^\circ\text{C}$ for 168 h (for soles)

Safety rubber canvas boots for miners are used by workers engaged in underground mining of coal, mica, silica, clay, stone and other minerals and also in other mining operations. Workers engaged in wet condition, sometimes face problem of upper fabric being weakened due to continuous use in contact with water. To address these problems and to align this standard with ISO standards, the fifth revision was made in 2003.

In 2004 through amendment No. 1, 'IS 3976 Safety rubber canvas boots for miners' was redesignated as 'IS 3976 Protective rubber canvas boots for miners'. This was done because the Footwear Sectional Committee, CHD 19, adopted 'ISO 8782 (Parts 1, 2, 3 and 4)' as dual number Indian Standards 'IS 15298 (Parts 1, 2, 3 and 4)'. All types of safety, protective and occupational footwear standards formulated by Footwear Sectional Committee, CHD 19, were being aligned with the definition of safety, protective and occupational footwear as given in ISO 8782-1.

In this revision, 'Protective rubber canvas boots for miners' is being redesignated as 'Safety rubber canvas boots for miners' and the standard is being aligned, with respect to requirements and test methods, with IS 15298 (Part 1) : 2015 'Personal protective equipment: Part 1 Test methods for footwear (*second revision*)' and IS 15298 (Part 2) : 2016 'Personal protective equipment: Part 2 Safety footwear (*second revision*)'. The reason for redesignating the rubber canvas boots as "safety" boots is that the Footwear Sectional Committee recommended the boots to withstand impact energy levels used to test "safety" boots. Provisions of polymeric component in addition with use of rubber are incorporated to provide wide scope of application of polymer/rubber as per requirement of purchaser/user. Physical, material and constructional requirements are incorporated for such application.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

SAFETY RUBBER CANVAS BOOTS FOR MINERS — SPECIFICATION (Sixth Revision)

1 SCOPE

This standard prescribes requirements and method of sampling and test for safety rubber canvas boots with steel toe cap for protection of miners.

2 REFERENCES

The Indian Standards listed in Annex A contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed in Annex A.

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 2050 shall apply. In addition, the following definitions shall apply to the standard.

3.1 Compact Insole/Insocks — Suitable rubber/polymer/elastomer having density not less than 0.9 g/cm^3 , with textile coating.

3.2 Compact Outsole — Suitable rubber/polymer/elastomer having density not less than 0.9 g/cm^3 .

3.3 Lining — Material covering the inner surface of the upper.

3.4 Quarter Lining — Material covering the inner surface of the quarters of the upper.

3.5 Safety Footwear — Footwear incorporating protective features to protect the wearer from injuries which could arise through accidents in the working area. The footwear is designed to give protection against impact when tested at an energy level of at least 200 J and against compression when tested at a load of at least 15 kN.

3.6 Safety Toe Cap — Footwear component built into the footwear designed to protect the toes of the wearer from impacts up to an energy level of at least 200 J and compression at a load of at least 15 kN.

3.7 Vamp Lining — Material covering the inner surface of the forepart of upper.

4 TYPES

This standard covers two types of safety footwear for protection of miners, namely Type 1 and Type 2, typical

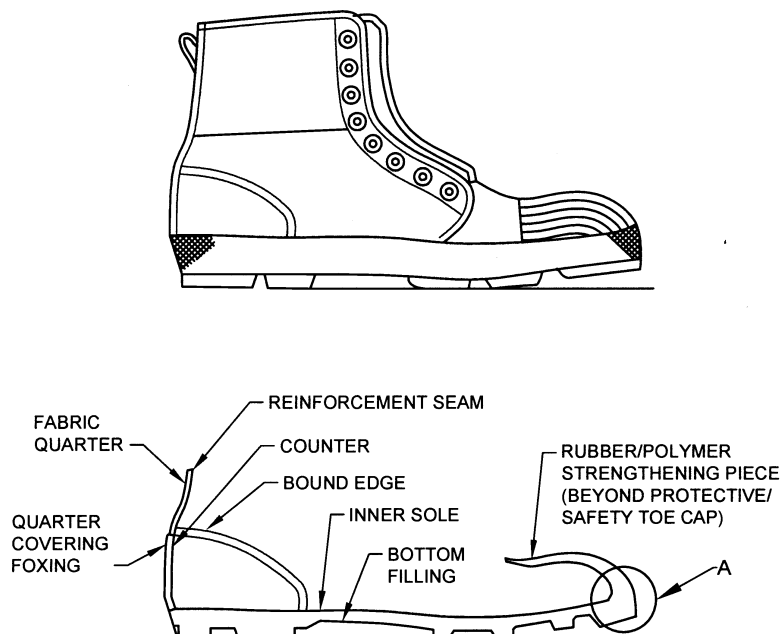


FIG. 1 SAFETY RUBBER CANVAS BOOTS FOR MINERS, TYPE 1

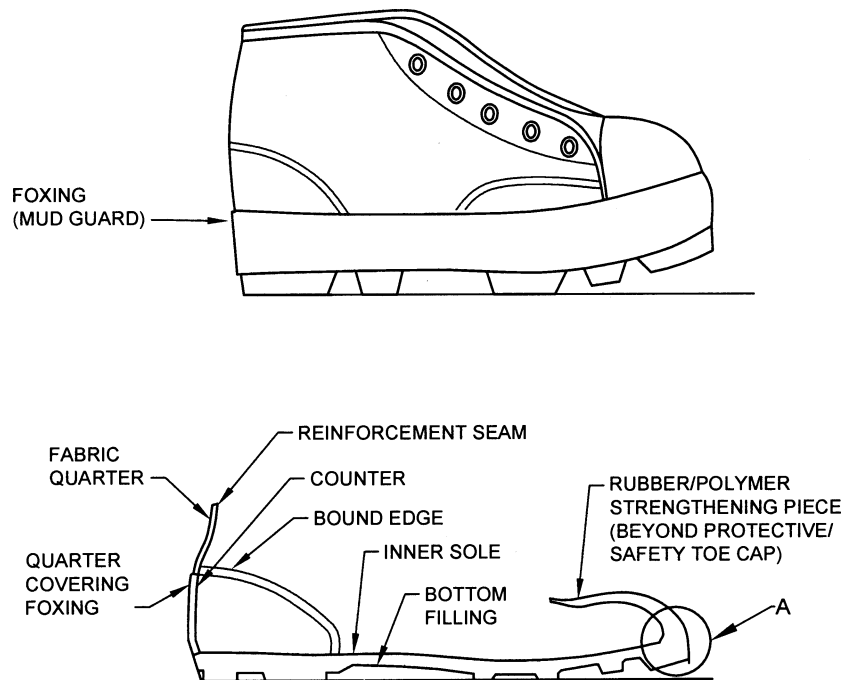


FIG. 2 SAFETY RUBBER CANVAS BOOTS FOR MINERS, TYPE 2

of their performance requirements as shown in Fig. 1 and Fig. 2 respectively.

NOTE — Type 1 boots are preferred where there is water accumulation or in slurry conditions of mining. The level of water in slurry conditions shall not be more than ankle height. Type 2 Boots are preferred for use in dry conditions of mining.

5 REQUIREMENTS

5.1 Design

The boots of Type 1 and Type 2 are recommended to have typical design as shown in Fig. 1 and Fig. 2, respectively, though it is not mandatory.

5.1.1 Fittings

Fittings of the footwear shall be in conformity to Table 9 of IS 1638 (measurement of men's lasts) and Table 8 of IS 1638 (measurement of women's lasts).

5.2 Material

5.2.1 Upper

Upper material shall be composite and adhere together having outer layer and inner layer of suitable textile material and shall conform to the following requirements:

5.2.1.1 Composite upper material shall comply with consolidation test as per **5.10**.

5.2.1.2 Composite upper material shall comply with tear strength as per **5.4.3** of IS 15298 (Part 2).

5.2.1.3 Composite upper material shall develop no cracks before 150 000 cycles when tested in accordance with **6.5** of IS 15298 (Part 1).

5.2.1.4 For Type 2 footwear, the composite upper material shall comply with requirements of water vapour permeability and coefficient as prescribed in **5.4.6** of IS 15298 (Part 2).

5.2.1.5 Inner layer of upper shall meet requirement of abrasion resistance as prescribed in **5.5.2** of IS 15298 (Part 2).

5.2.2 Compact Insole/Compact Insocks/Counter Stiffener Lining

Textile material shall be used as lining material for compact insole/compact insocks / counter stiffener. It shall meet the requirement of tear strength as prescribed in **5.6.1** of IS 15298 (Part 2).

5.2.2.1 Abrasion resistance of compact insole/insocks/ counter stiffener

When textiles used as lining for all the above are tested in accordance with **6.12** of IS 15298 (Part 1), the lining shall not develop any holes before the following number of cycles has been performed:

- Dry – 25 600 cycles, and
- Wet – 12 800 cycles.

5.2.3 Coated Binding Material

Coated binding materials shall conform to the requirements given in col 3 of Table 1 when tested according to the methods prescribed in col 4 of Table 1.

Table 1 Requirements for Coated Binding Material
(Clause 5.2.3)

| Sl No. | Characteristics | Requirements | Methods of Test, Ref to |
|--------|--|--------------|-------------------------|
| (1) | (2) | (3) | (4) |
| i) | Width in mm, <i>Min</i> | 13 | IS 1954 |
| ii) | Breaking load in N, <i>Min</i> (50 cm grip length test specimen) | 360 | Annex C |

5.2.3.1 In case of cotton black binding material, the same shall be free from sulphur dyes when tested in accordance with Annex B.

5.2.4 Reinforcing Material

Quarter at the back of the upper, heel region shall have reinforcement with 25 mm minimum wide strip made out of composite upper as specified in 5.2.1 or any other material having similar tear strength as prescribed in 5.2.1.2, as agreed to between the purchaser and the manufacturer. Reinforcing material of similar tear strength at specific portion of upper to meet the required performance requirement of purchaser may also be provided as agreed to between the manufacturer and the purchaser.

5.2.5 Compact Sole Heel

5.2.5.1 The design of polymeric / rubber compact sole heel and other polymeric / rubber components shall be as agreed to between the purchaser and the manufacturer. The compact sole heel shall be made out of polymeric/rubber components and the typical design recommendation (not mandatory) of compact sole heel is as shown in Fig. 3. Sectional view of Type 1/Type 2 toe position is given in Fig. 4.

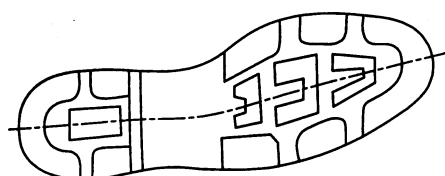


FIG. 3 DESIGN OF SOLE HEEL

5.2.5.2 Compact sole heel shall conform to

requirements prescribed in col 3 of Table 2 when tested as per corresponding test methods prescribed in col 4 of Table 2.

Table 2 Physical Requirements for Compact Sole Heel
(Clause 5.2.5.2)

| Sl No. | Characteristics | Outer Sole Heel | Method of Test, Ref to IS |
|--------|---|-----------------|---------------------------|
| (1) | (2) | (3) | (4) |
| i) | Hardness (IRHD) | 60 ± 5 | 3400 (Part 2) |
| ii) | *Change in hardness after accelerated ageing at 100 ± 2 °C for 24 h | +5 -2 | 3400 (Part 4) |

* Test is performed when rubber is used as a polymer.

5.2.5.3 Ageing for whole footwear

When rubber is used for manufacturing boots or when the outer sole heel is made of bi-polymer, the finished boots shall be aged at 100 ± 2°C for 24 h. On completion of test, all rubber components shall not develop any sign of tackiness or brittleness.

5.2.5.4 Thickness of compact sole heel

Thickness of compact sole heel of the boots shall comply with the thickness and material requirements prescribed in Table 3.

5.2.6 Thread for Upper Closing

The length (m/kg) and construction of sewing thread shall conform to requirements as prescribed in Table 4. Colour of thread will be as agreed to between the manufacturer and the purchaser. In case

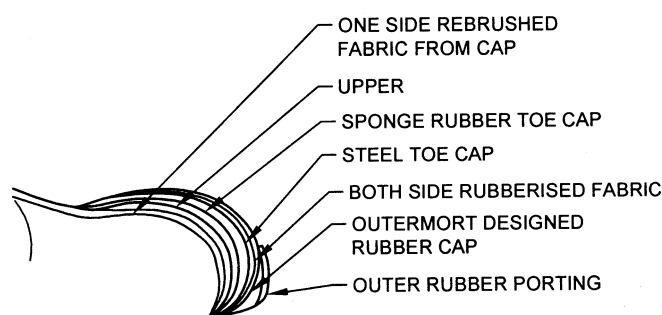


FIG. 4 TOE POSITION, SECTIONAL VIEW

Table 3 Requirement of Polymeric/Rubber Compact Sole Heel
(Clause 5.2.5.4)

| Sl No. | Components | Material | Thickness, Min, mm |
|--------|------------------|---|--------------------|
| (1) | (2) | (3) | (4) |
| i) | Compact Sole: | | |
| | a) Fore part | | |
| | 1) With cleat | Suitable polymer/rubber for mining conditions | 10 |
| | 2) Without cleat | Suitable polymer/rubber for mining conditions | 6 |
| | b) Compact heel | | |
| | 1) With cleat | Suitable polymer/rubber for mining conditions | 15 |
| | 2) Without cleat | Suitable polymer/rubber for mining conditions | 9 |

of black cotton thread, the same shall be free from sulphur dyes when tested in accordance with Annex B.

5.2.7 Safety Toe Cap

Safety toe cap as per 3.6 shall be fitted into the footwear and must not come out while in use.

5.2.8 Laces

5.2.8.1 The boots shall be provided with laces having minimum length of 115 cm for Type 1 and minimum 100 cm for Type 2.

5.2.8.2 Minimum breaking load of 60 kg is to be achieved when tested between 18 cm grip length in accordance with Annex C.

5.2.8.3 In case of cotton lace of black colour, the same shall be free from sulphur dyes when tested in accordance with Annex B. Two ends of the laces shall be provided with plastic tips.

5.2.8.4 Colour of the lace shall be as agreed to between the purchaser and the manufacturer.

5.2.9 Eyelets

Aluminum eyelets of external collar diameter not less than 10 mm and wall thickness of 0.30 to 0.35 mm shall be used.

5.2.10 Counter Stiffener

A counter stiffener, made out of textile reinforced with

polymer/rubber including (thermoplastic) having thickness not less than 1.5 mm is to be stitched at inside of upper so as to fortify the back of the footwear at joints of quarter.

5.3 Construction

5.3.1 This is an unlined footwear. Stitch used in the upper shall be 23 stitches minimum per dm (average of 3 measurements). Eight pairs of eyelets for Type 1 and 5 pairs of eyelets for Type 2 or as agreed to between the purchaser and the manufacturer, as the case may be, shall be fitted to each upper.

5.3.2 The tongue shall be made out of composite upper material and shall be half bellow type for Type 2 and full bellow type for Type 1.

5.3.3 The edges of the upper, tongue and counter shall be bound with binding tape.

5.3.4 Type 1 boots shall be provided with jugloop. Vamp and half of the quarter of Type 1 boots shall be reinforced with polymer/rubber sheet as agreed to between the purchaser and the manufacturer.

5.3.5 Outer toe cap shall be provided which is made of polymer/rubber and it shall be strongly adhered such that it shall not open up or come out while in use. Toe of the boot shall be reinforced with safety toe cap. Suitable reinforcement is to be provided between face of upper and safety toe cap as agreed to between the manufacturer and the purchaser.

Table 4 Requirement of Sewing Tread
(Clause 5.2.6)

| Sl No. | Components | Material | Maximum Length (m/kg) | Method of Test, Ref to IS |
|--------|----------------------------------|---|-----------------------|---------------------------|
| (1) | (2) | (3) | (4) | (5) |
| i) | Sewing thread for body | Sewing polyester thread variety No. 9 (145 dtex ×6) Ticket Number 35 | 12 100 | 9543 |
| ii) | Sewing thread for piping/binding | Sewing polyester thread variety No. 5 (145 dtex ×3) Ticket Number 70 | 2 100 | 9543 |

NOTE — Any other thread as agreed to between the purchaser and the manufacturer may also be used, however the length (m/kg) should not exceed the values specified above.

5.3.6 A designed foxing of width of minimum 25 mm and of thickness of minimum 2 mm is to be provided. The foxing shall not extend the edges of the outer sole.

5.3.7 Two pairs of detachable insoles are to be provided. The insoles shall be compact in nature having thickness not less than 2 mm.

5.4 Finish

In appearance, general workmanship and in all other respects with regard to finish and get up of the footwear, the footwear shall be matching to the approved sample of the purchaser.

5.5 Mass

The mass of one pair of finished footwear of size 8 shall not exceed 1 500 g for Type 1 and 1 400 g for Type 2 with an increase or decrease of 100 g for each bigger or smaller size, respectively.

5.6 Height of Upper

Height of upper of the boots shall conform to column 5 (Design C) and column 4 (Design B) of **5.2.2**, Table 4 of IS 15298 (Part 2) for Type 1 and Type 2, respectively when measured as per **6.2** of IS 15298 (Part 1) on the inside of the back of the footwear and from seat of the insole to top edge of the upper.

5.7 Performance Test

When safety footwear is tested in accordance with the method described in **5.4** of IS 15298 (Part 1), at an impact energy of (200 ± 4) J, the clearance under the toecap at the moment of impact shall be in accordance with Table 5. In addition, the toecap shall not develop any cracks which go through the material, that is, through which light can be seen.

Table 5 Minimum Clearance under Toecaps at Impact
(Clauses 5.7 and 5.11.1)

| Sizes of Footwear | | Minimum Clearance (in mm) |
|-------------------|---------------|------------------------------|
| French Size | UK Size | |
| 36 and below | Upto 3½ | 12.5 |
| 37 and 38 | 4 to 5 | 13.0 |
| 39 and 40 | 5½ to 6½ | 13.5 |
| 41 and 42 | 7 to 8 | 14.0 |
| 43 and 44 | 8½ to 10 | 14.5 |
| 45 and above | 10½ and above | 15.0 |

5.8 Upper/Outsole Bond Strength

When the footwear is tested in accordance with the method prescribed in **5.2** of IS 15298 (Part 1), the bond strength shall not be less than 4.0 N/mm, unless there is tearing of the sole in which case the bond strength shall not be less than 3.0 N/mm.

5.9 Sole Interlayer Bond Strength for Bi-polymer and Bi-density Sole

When tested in accordance with **5.2** of IS 15298 (Part 1), the bond strength between the outer or cleated layer and the adjacent layer shall not be less than 4.0 N/mm unless there is tearing of any part of the sole, in which case the bond strength shall not be less than 3.0 N/mm.

5.10 Consolidation Test

Representative sample of width 25 ± 0.5 mm are cut out from the quarter of the upper along the length of boot. The plies are separated by breaking the bond. Carry out the test on two specimens in accordance with IS 3400 (Part 5). There shall be no separation at a load of 1.5 kg.

5.11 Compression Resistance

5.11.1 When safety boots are tested in accordance with **5.5** of IS 15298 (Part 1), the clearance under the toe cap at a compression load of $15 \text{ kN} \pm 0.1 \text{ kN}$ shall be in accordance with Table 5.

5.12 Internal Length of Toe Cap

For safety boots, internal length of the toe cap shall meet the specification given in Table 5 of IS 15298 (Part 2) when tested as per **5.3** of IS 15298 (Part 1).

5.13 Energy Absorption Test

When footwear is tested in accordance with the method prescribed in **5.14** of IS 15298 (Part 1), the energy absorption of the seat region shall not be less than 20 J.

6 OUTSOLE

6.1 Abrasion Resistance of Compact Outsole

When outsole is tested in accordance with **8.3** of IS 15298 (Part 1), the relative volume loss shall not be greater than 250 mm^3 for materials having density 0.9 g/cm^3 or less, and not greater than 150 mm^3 for materials with density greater than 0.9 g/cm^3 .

6.2 Flexing Resistance of Compact Outsole

When outsole is tested in accordance with **8.4** of IS 15298 (Part 1), the cut growth shall not be greater than 4 mm before 30 000 cycles.

6.3 Tear Strength of Compact Outsole

When outsoles are tested in accordance to **8.2** of IS 15298 (Part 1), the tear strength shall be not less than 8 kN/m for material having density higher than 0.9 g/cm^3 and when density of material is less than or equal to 0.9 g/cm^3 , tear strength shall not be less than 5 kN/m.

6.4 Resistance to Hot Contact — Sole Heel

When sole heel is tested in accordance with **8.7** of

IS 3976 : 2018

IS 15298 (Part 1), the material shall not melt/deform and shall not develop any cracks when bent around the mandrel.

6.5 Hydrolysis

When bottom sole or other components are made out of polyurethane, the same shall be tested in accordance with 8.5 of IS 15298 (Part 1) and the same shall comply with 5.8.5 of IS 15298 (Part 2).

7 ADDITIONAL PROPERTIES, IF REQUIRED BY PURCHASER

7.1 Resistance to Fuel

When the footwear is subjected to use in areas having oil/grease including oil mines, the footwear shall comply with 6.4.2 of IS 15298 (Part 2) when tested in accordance with 8.6.1 of IS 15298 (Part 1).

7.2 Resistance to Electricity

When the footwear is subjected to use in wet condition and is likely to have exposure to electricity or the footwear is being used as electrically insulating footwear, the footwear shall comply with 6.2.2.3 of IS 15298 (Part 2).

8 CHEMICAL REQUIREMENTS

The footwear shall meet the chemical requirements as given in Table 6.

9 BIS CERTIFICATION MARKING

The product may also be marked with the Standard Mark.

9.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standard Act, 2016*, as amended time to time, and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be

granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

10 MARKING

Each boot shall be clearly and permanently marked with the followings:

- Size and Type,
- Manufacturer's name / brand,
- Year and month of manufacture, and
- Any other statutory marking.

All markings shall be at inside of tongue so that least damage happens during mining operation.

11 PACKING

Packing of the finished footwear will be as agreed to between the purchaser and the manufacturer. Each pack having a pair of boot shall be supplied with following information in English and Hindi:

- Name and full address of manufacturer,
- Detail of customer care service provider,
- Area of application of the boot and limitation of use,
- Instruction for storage and maintenance,
- Drying procedure of wet boots and cleaning of boots for proper service,
- Obsolescence dead line or period of obsolescence, and
- Whether Green Footwear (Bio Degradable) or not.

12 SAMPLING AND CERTIFICATION FOR CONFORMITY

The scale of sampling and criterion for conformity shall be followed as prescribed in IS 6368 or as agreed to between the purchaser and the manufacturer.

Table 6 Chemical Requirements
(Clause 8)

| SI No. | Material | Requirements | | | | Test Method Ref to IS |
|--------|---|----------------|-----------------|----------------|--|-----------------------|
| | | Upper (Fabric) | Lining (Fabric) | Laces (Fabric) | Sole & Heel (Rubber/ elastomer/ polymer) | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| i) | Coupled amines released from azo-dyes (sum parameters) in mg/kg, <i>Max</i> | 30 | 30 | 30 | — | 15570 |
| ii) | Free sulphur | Absent | — | — | — | 3400 (Part 22) |
| iii) | pH value of aqueous extract | 6.0-8.5 | 6.0-8.5 | 6.0-8.5 | — | 1390 (Cold method) |
| iv) | Lead content, ppm, <i>Max</i> | — | — | — | 2.0 | 12240 (Part 5) |

ANNEX A*(Clause 2)***LIST OF REFERRED INDIAN STANDARDS**

| <i>IS No.</i> | <i>Title</i> | <i>IS No.</i> | <i>Title</i> |
|-----------------|---|-----------------------|--|
| 1390 : 1983 | Methods for determination of pH value of aqueous extracts of textile materials | (Part 5) : 1986 | Adhesion of rubbers to textile fabrics |
| 1638 : 1969 | Specification for sizes and fittings of footwear | (Part 22) : 1984 | Chemical analysis |
| 1954 : 1990 | Determination of length and width of woven fabrics — Methods | 6368 : 1971 | Methods of sampling of rubber and rubber combination footwear |
| 2050 : 1991 | Glossary of terms relating to footwear | 9543 : 2015 | Textiles — Spun polyester sewing threads — Specification |
| 3400 | Methods of test for vulcanized rubbers : | 12240 (Part 5) : 1988 | Method of test for polyvinyl chloride boots: Determination of lead content |
| (Part 2) : 2014 | Rubber, vulcanized or thermoplastic determination of hardness (hardness between 10 IRHD and 100 IRHD) | 15298 | Personal protective equipment |
| (Part 4) : 2012 | Accelerated ageing and heat resistance | (Part 1) : 2015 | Test methods for footwear (<i>second revision</i>) |
| | | (Part 2) : 2016 | Safety footwear |
| | | 15570 : 2005 | Method of test — Detection of banned azo colourants in coloured textiles |

ANNEX B*(Clauses 5.2.3.1, 5.2.6 and 5.2.8.3)***METHOD FOR DETECTION OF SULPHUR DYES IN BLACK COLOURED LACES NEWAR (TAPE) THREAD AND FABRIC****B-1 PROCEDURE**

B-1.1 Boil the laces in alkaline hydrosulphite solution for 1 min. If the shade is reduced to pale brown or yellow colour and on oxidation restored to the original colour, sulphur dyes shall be suspected to be present.

B-1.2 For confirmation, boil the laces in acid stannous chloride solution in a test tube covered with a piece of filter paper moistened with lead acetate. A blackish/ brown stain with metallic luster confirms the presence of sulphur dyes.

ANNEX C

(Clause 5.2.8.2 and Table 1)

METHOD FOR DETERMINATION OF BREAKING LOAD AND ELONGATION AT BREAK

C-0 GENERAL

Breaking force and extension at break of coated binding material and/or laces can be tested in the dry state and in the wet state. The material is extended until it breaks using a tensile testing machine.

C-1 PROCEDURE

The machine given in Fig. 5 is used for measurement of breaking load.

Prepare three specimens of length sufficient to enable

satisfactory clamping in the jaws while leaving a test length of 500 mm between them. After conditioning, extend each specimen by tensile testing with the machine whose jaws separate at a rate of 100 mm/min until the test sample breaks. Record the maximum force obtained in Newton, and the extension at break if required. The arithmetic mean of three results is reported. If the test sample is constructed from several component parts, such as a case and a core, carefully watch the test specimen as it is extended and record the force when each of these component parts break.

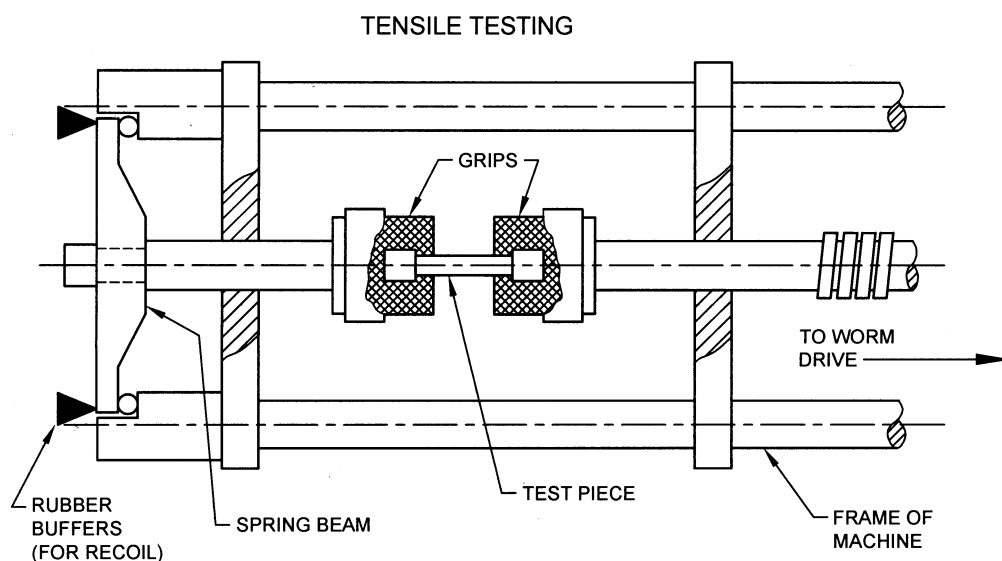


FIG. 5 MACHINE FOR TENSILE TEST WITH GRIPS AND SAMPLE IN-BETWEEN

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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002

Telephones : 2323 0131, 2323 3375, 2323 9402

Website: www.bis.org.in

Regional Offices:

Telephones

| | | |
|----------|--|--|
| Central | : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002 | { 2323 7617 2323 3841 |
| Eastern | : 1/14 C.I.T. Scheme VII M, V. I. P. Road, Kankurgachi KOLKATA 700054 | { 2337 8499, 2337 8561 2337 8626, 2337 9120 |
| Northern | : Plot No. 4-A, Sector 27-B, Madhya Marg, CHANDIGARH 160019 | { 26 50206 265 0290 |
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| Western | : Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400093 | { 2832 9295, 2832 7858 2832 7891, 2832 7892 |

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